



Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

HIGH-PERFORMANCE MODULATORS SPARK SECOND PHASE OF PHOTONICS REVOLUTION



Materials and Manufacturing scientists and engineers working in conjunction with Air Force contractor, IPITEK, achieved significant advancements in the research and development of low-cost, high-performance electro-optic polymer modulators instrumental in achieving very high modulation rate signals on optical carrier beams. Electro-optic polymer modulators satisfy a number of current and future military needs. The commercial potential for low-cost, high-performance electro-optic polymer modulator technology could impact the entire spectrum of information communication systems. The commercial market potential for fiber-to-the-home is huge, given the estimated 100 million households and 50 million potential commercial and institutional users in the United States alone.



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Accomplishment

The directorate's Survivability and Sensor Materials Division transitioned this new technology base to the Air Force and the Department of Defense. Technology transfer for commercial applications is also ongoing and could mark the beginning of a second phase of the photonics revolution that began more than 2 decades ago.

Electro-optic polymers are an intense Air Force-sponsored research and development effort, and remarkable improvements in their performance have been seen the past 15 years. Building on the gains made in previous research, IPITEK designed a program to tackle the challenging science and engineering problems of transitioning these materials into current, state-of-the-art commercial and military systems.

Background

After more than 2 decades of the first phase of the photonics/fiber optics revolution, there is now an increasing need for transmitting vast amounts of information and in particular, a need for active optical switching within the networks. There are also important military uses; for example, inter-satellite communications and phased array radar. Inherent in all of these systems is the necessity to impress very high modulation rate signals on optical carrier beams, whether done in an analog or digital fashion.

The commercial potential for the technology developed under this dual-use program is huge. The primary market being targeted is the cable TV distribution market, which could become a major Internet distribution market as well. Electro-optic polymer technology can also be adapted to ultrahigh-frequency electromagnetic field sensors for numerous military applications. The unique advantages of such field sensors include the ability to make compact sensor arrays and minimal disturbance of the electromagnetic fields being sensed due to the all-dielectric materials being employed. Another important application of this technology involves high-speed, digitally tunable wavelength filters, which are key devices for dynamically reconfigurable optical add-drop multiplexers in fiber optical networks.

Materials and Manufacturing
Technology Transfer

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (04-ML-35)